



## **Solar Controller / Battery Charger**

**ZS-30A / ZS-40A**

**Input: DC12V Solar panel (Max. 25V)**

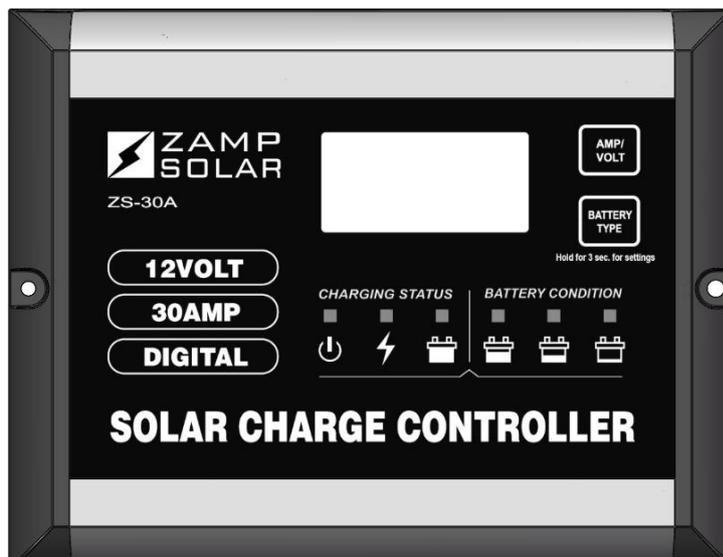
**Output: DC 12V 30A (ZS-30A)**

**DC 12V 40A (ZS-40A)**

**User's Manual**

## FEATURE

- Advanced MCU control pulse width modulated (PWM) technology, high efficiency operation.
- Target for LiFePO4, LTO (Lithium Titanium Oxide), Gel, AGM, Conventional lead-acid (WET) and Calcium Batteries.
- Built in regulator to prevent your battery from being overcharged. Overcharging occurs when the charge voltage is unregulated. This can result in premature battery failure.
- Come with regulator to prevent your battery from being under charged, in the solar energy field, battery undercharge always occurs, especially on some Conventional lead –acid or Calcium batteries; The unit provides an automatic Equalization feature for deeply drained Conventional lead acid battery or Calcium battery, as well as provides a cycling automatic Equalizing feature every 28 days.
- Can be connected to the battery permanently to keep the battery fully charged by using a process called “floating”. This means the controller will stop charging when the battery is full and will automatically start charging the battery as required. This process will also reduce water loss and help prevent the battery from ‘drying out’.
- Protects your battery from discharge at night. Under low light or no light conditions the solar panel voltage could be less than the battery voltage. The unit contains a special circuit which prevents current flowing back from the battery and into the solar panel.
- Colored LED’s to easily indicate the operational status and battery conditions.
- Digital LCD to directly display battery voltage, charging current, charging capacity (Amp hour), battery types and faulty codes.
- Provides plug-in remote digital display meter (Optional).
- Provides external battery temperature sensor (Optional).
- Multi charging protections against reverse polarity, short circuit, over temperature, over voltage, etc.
- Surface Mount or Flush Panel Mount options.
- Conformal-coating circuit boards and plated terminals apply to hostile environments.



**For use with 12Volt Solar Panel Only**  
**Suitable for Solar panels up to 510 Watts / ZS-30A; 680Watt / ZS-40A**

## WARNING – IMPORTANT PLEASE READ

- This charger is designed for indoor use only and should never be exposed to rain.
- Do not disassemble the controller. Take to a qualified person if the unit requires repairing.
- Lead acid, LiFePO4, LTO batteries can be dangerous. Ensure no sparks or flames are present when working near batteries.
- Eye protection should always be used. Never short circuit the battery
- Given sufficient light solar panels always generate energy even when they are disconnected.
- Accidental 'shorting' of the terminals or wiring can result in sparks causing personal injury or a fire hazard. We recommend that you cover up the panel(s) with some sort of soft cloth so you can block all incoming light during the installation. This will ensure that no damage is caused to the Solar Panel or Battery if the wires are accidentally short circuited.
- Always install a battery fuse on each circuit including the solar controller
- Do not reverse connect the wires to the solar panel or battery

## MOUNTING THE DEVICE

The Solar Controller has two mounting options.

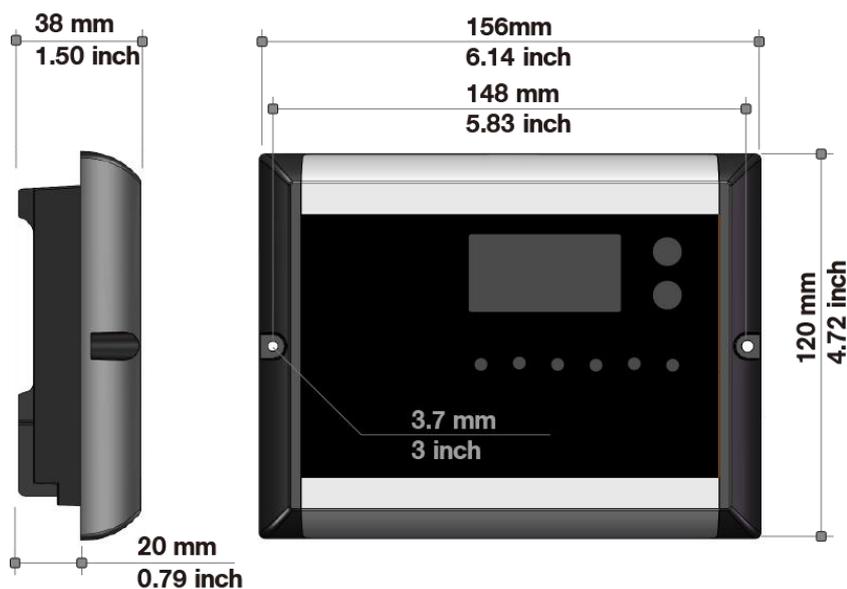
### 1. Surface mount:

The quickest and easiest way to mount the unit is to use the two plastic spacers and self tapping screws supplied and mount the unit to a flat surface,

### 2. Flush (panel) mount:

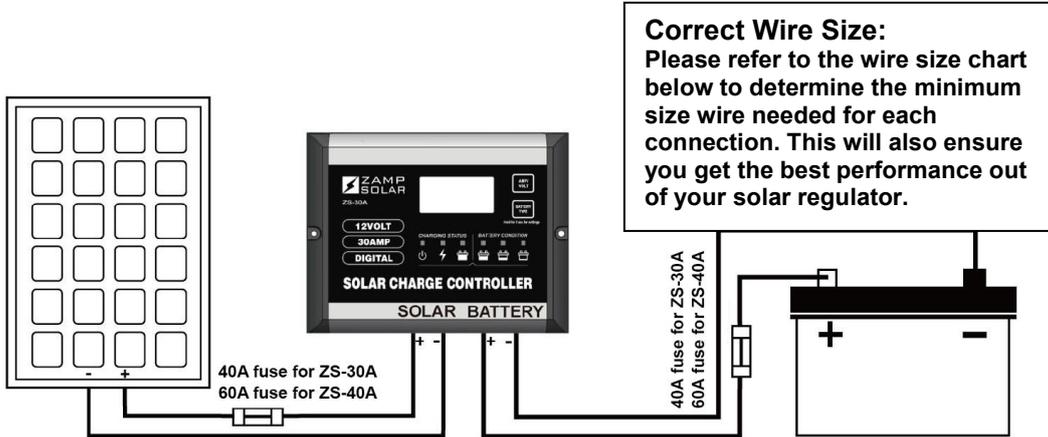
Before deciding to use this mounting method, please ensure there is sufficient depth behind the controller or in the cavity. (Refer to Diagram below)

Using the dimensions shown in the following diagram, mark a 105mm x 130mm rectangle where you wish to mount the controller and cut-out the panel opening then use the two self- tapping screws supplied to secure the unit.



## WIRING CONNECTIONS

To protect the Battery and the Solar Panel, we strongly recommend that you place a 40A inline fuse for ZS-30A (60A fuse for ZS-40A) on the positive wire on both the “Solar” and “Battery” Circuits. (As close to the Battery /Panel as possible)  
 The Solar Controller has 4 terminals which are clearly marked ‘Solar’ and ‘Battery’. There is a (12V) and earth (GND) terminal for each circuit.  
 Refer to the wiring diagram below.



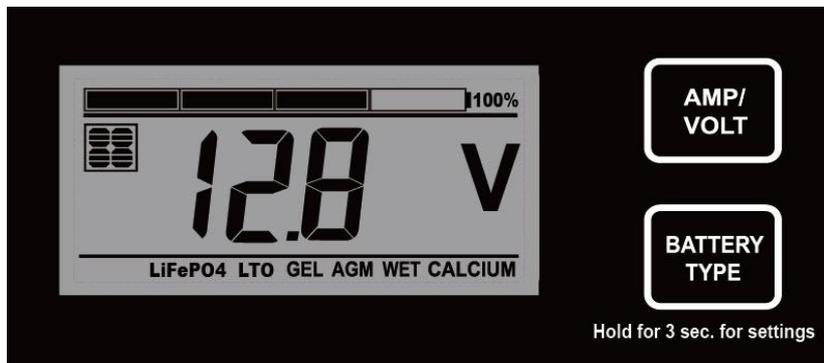
	Battery Connection		Solar Array Connection		
Length of Wire	5ft	10ft	10ft	15ft	20ft
Size (AWG)	10	8	10	8	8

1. Using the Terminals supplied, crimp the terminals on your Solar Array wires and connect to the Solar Panel like shown.
2. Using the Terminals supplied, crimp the terminals on your Battery wires and connect to the Battery like shown.

When the connections are completed, the Solar Controller will start working automatically.

## OPERATION - LCD DISPLAY

Please check your battery manufacturer’s specifications to select correct battery type. The unit provides 6 battery types for selections: LiFePO4, LTO, Gel, AGM, WET (conventional lead acid), and Calcium.



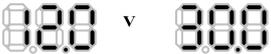
Press **BATTERY TYPE button** and hold for 3 seconds to go into your battery type selection mode, the battery type you select will be shown on the LCD meter, the default setting is AGM Battery; the controller will automatically memorize your battery type setting.

**Caution: Incorrect battery type setting may damage your battery.**

When the controller powers on, the unit will run self-qualify mode and automatically show below items on LCD before going into charging process

 Self-test starts, digital meter segments test

 Software version test

 Rated voltage and current test

 External battery temperature sensor test (if connected)

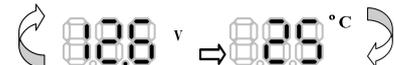
 Indicates the solar panel connected.

After going into charging process, the LCD displays the charging statuses as below:  
Press **VOLT / AMP button** in sequence, the LCD will display in turn with Battery Voltage, Charging Current, Charged capacity (Amp-hour) and Battery Temperature (if external temperature sensor connected)

#### Display in the day time-



#### Display during the night-



The **VOLT / AMP button** can be changed at any time during charging process.

You also can visually monitor your battery charging condition for each battery; there is a LCD bar to show the percentage of charge, you can easily see the battery is charged to 25%, 50%, 75% or 100%.

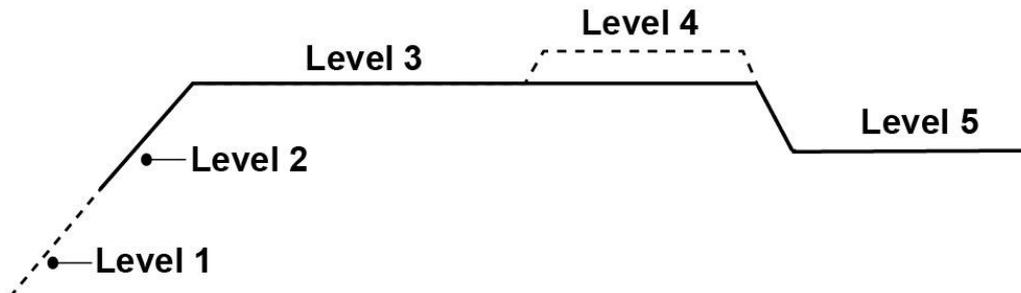


The LCD also can be treated as an independent voltage meter or thermometer. A voltage less than 11.5V Volts indicates that the battery is discharged and needs re-charging.

### CHARGING STAGES

**The unit has a 5-stage charging algorithm.**

Soft Charge (Level 1) – Bulk Charge (Level 2) – Absorption charge (Level 3) – Equalizing Charge\* (Level 4) – Float Mode (Level 5)



**Soft Charge**- When batteries suffer an over-discharge, the controller will softly ramp the battery voltage up to 10V.

**Bulk Charge**-Maximum current charging until batteries rise to Absorption level

**Absorption Charge**-Constant voltage charging and battery is over 85%.

**Equalization Charge\***-Only for WET battery or Calcium battery type, when the battery is deeply drained below 10V, it will automatically run this stage to bring the internal cells as an equal state and fully complement the loss of capacity. (LiFePO4, LTO, Gel and AGM battery do not run Equalization charge)

**Float Charge**-Battery is fully charged and maintained at a safe level.  
A fully charged Lead acid battery (GEL, AGM, WET battery) has a voltage of more than 13.6 Volts; A fully charged LiFePO4 or LTO battery has a voltage level of 13.4V.

**OPERATION - L.E.D. INDICATION**

The 6 LED's indicate the charging status and the battery condition						
	Red	Blue	Green	Green	Yellow	Red
Solar Power Present-No battery connected	ON	OFF	OFF	OFF	OFF	Flash
Soft charging	ON	Flash	OFF	OFF	OFF	ON
Bulk charging	ON	ON	OFF	Subject to battery voltage		
Absorption charging	ON	ON	OFF	ON	OFF	OFF
Equalization charging	ON	ON	OFF	ON	OFF	OFF
Float charging	ON	OFF	ON	ON	OFF	OFF
Solar panel weak	Flash	OFF	OFF	Subject to battery voltage		
At night, no charge	OFF	OFF	OFF	Subject to battery voltage		
Battery Voltage below 11.5V (+/-0.2V)	ON	ON	OFF	OFF	OFF	ON
Battery Voltage between 11.5V - 12.5V(+/-0.2V)	ON	ON	OFF	OFF	ON	OFF
Battery Voltage above 12.5V (+/-0.2V)	ON	ON	OFF	ON	OFF	OFF

**ABNORMAL OPERATION MODE**

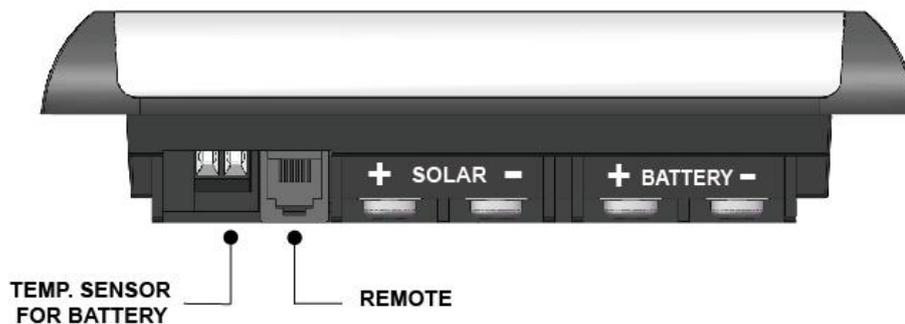
Solar panel abnormal mode	LCD display	LED indication	LCD backlight
Solar panel weak		☰ Flash	ON
Solar panel reverse connection	888	☰ Flash	Flash
Solar panel over voltage (> 26.5V)	888	☰ Flash	Flash

Battery abnormal mode	LCD display	LED indication			LCD backlight
Battery disconnected or less than 3.0V	888	☰ Flash	☰ Flash	☰ Flash	Flash
Battery reverse connection	888	☰ Flash			Flash
Battery over voltage than > 17.5V	888	☰ Flash			Flash
Battery temperature over 65C	888	☰ Flash	☰ Flash	☰ Flash	Flash

The solar controller abnormal mode	LCD display	LED indication	LCD backlight
The controller over temperature protection	888		Flash

## OPTIONAL EXTERNAL DEVICE

The controller provides two optional devices (excludes in the packaging box).



### Optional external Battery temperature sensor:

As an option, the unit provides a port to connect the external battery temperature sensor; if the external battery temperature sensor is connected, the unit will optimize the charging performance subjected to the battery temperature detected and also provide the battery over temperature protection, in some cases, if battery over temperature occurs, the controller will automatically stop charging.

### Optional external Remote display meter:

As an option, the unit also provides a port to connect the external Remote display meter for some special location needed. The display content on the Remote meter is same as the display on the controller.

## SPECIFICATIONS

<b>1</b>	<b>Electrical Parameters</b>			
1-1	Rated solar panel amps ZS-30A /ZS-40A	30 / 40	Max.	AMP
1-2	Normal input Solar cell array voltage	15-22		VDC
1-3	Max. solar cell array voltage (output has no load)	25	Max.	VDC
1-4	The controller lowest operating voltage (solar or battery side)	8V	Min	VDC
1-5	Maximum voltage drop-Solar panel to battery	0.25	Max.	VDC
<b>2</b>	<b>Charging characteristics</b>			
2-1	Minimum battery start charging voltage	3	Min	VDC
2-2	Soft start charging voltage	3-10	+/-0.2	VDC
2-3	Soft start charging current ZS-30A / ZS-40A	Up to 15 / 20		AMP
2-4	Bulk charge voltage	10-14.0	+/-0.2	VDC
2-5	Absorption charging voltage at 25°C			
	--LTO type battery	14.0	+/-0.2	VDC
	--Gel type battery	14.1	+/-0.2	VDC
	--LiFePO4 battery	14.4	+/-0.2	VDC
	--AGM type battery (default setting)	14.4	+/-0.2	VDC
	--WET type battery	14.7	+/-0.2	VDC
	--Calcium type battery	14.9	+/-0.2	VDC
2-6	Absorption transits to Equalizing or Float condition:			
	--Charging current drops to ZS-30A / ZS-40A	1.0	+0.1	AMP
	-- or Absorption charging timer timed out	4		Hour
2-7	Equalization charging active			
	--Only for WET or Calcium battery			
	--Battery voltage discharged to less than	10	+/-0.2	VDC
	--Automatic equalizing charging periodical	28		Day
2-8	Equalization charging voltage at 25°C	15.5	+/-0.2	VDC
2-9	Equalization charging timer timed out	2		Hour
2-10	Float charging voltage at 25°C			
	-- For LTO and LiFePO4 battery	13.4	+/-0.2	VDC
	-- For Gel, AGM, WET, Calcium battery	13.6	+/-0.2	VDC
2-11	Voltage control accuracy	+/- 1%		
2-12	Battery temperature compensation coefficient	-24		mV/°C
2-13	Temperature compensation range	-20 ~ +50		°C
<b>3</b>	<b>Protection</b>			
3-1	Against reverse polarity or short circuit			
3-2	No reverse current from battery to solar at night			
3-3	Over temperature protection during charging	65		°C
3-4	Transient over voltage protection with TVS or varistor			
<b>4</b>	<b>Electrical parts</b>			
4-1	Input output terminal	M5 terminals		
4-2	Remote port	RJ-11 (6 pins)		
<b>5</b>	<b>Physical Parameters</b>			
5-1	Controller material	Plastic, Standard ABS		
5-2	Power terminal maximum stranded wire size	#6 AWG stranded-16 mm <sup>2</sup>		
5-3	Power terminal torque	Up to 17 in-lb (0.2n-m)		
5-4	Mounting	Vertical wall mounting		
5-5	IP grade	IP22,		
5-6	Net weight	Approx. 0.3kg / 0.66lb		
<b>6</b>	<b>Environmental characteristics</b>			
6-1	Operating temperature	-25 ~ 50°C / -13~122 °F		
6-2	Storage temperature	-40 ~ 85°C / -40~185 °F		
6-3	Operating Humidity range	100% no condensation		